Scalable AZTech™ Data Server
Enhancements for Planning and Operations:

Data Spooler/Logger Analysis and Requirements

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Maricopa County Department of Transportation

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19 Sep 2000

Preface

This document provides a primary reference for the Maricopa County Department of Transportation (MCDOT) Data Spooler/Logger (DS/L) project as a part of the Regional ITS Archived Data System (RADS).

Using this Document

This Analysis and Requirements Specification Document is a reference. The information presented here progresses from general, high-level system descriptions to more detailed, in-depth requirements.

Glossary

Below is a brief description of the acronyms and technical terms used in this document.

TERM	MEANING
ADOT	Arizona Department of Transportation
ALISS	Accident Location Identification & Surveillance System
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System not to be confused with AZTech™ Message System.
AVL	Automated Vehicle Location
AZTech™	"Arizona Technologies", name of the joint public and private partnership to deploy and integrate the Phoenix metropolitan area ITS and provide real-time travel information to the public.
bison	Parser generator
CCM	CORBA Component Model
CGI	Common Gateway Interface
CORBA	Common Object Request Broker Architecture
COTS	Commercially Off-The-Shelf
cron	The cron command starts a process that executes commands at specified dates and times, or regularly scheduled intervals.
CVO	Commercial Vehicle Operation
DOT	Department of Transportation
DPS	Department of Public Safety
DS/L	Data Spooler/Logger
DTD	Document Type Definition contains the XML tags and their attribute(s).
EBNF	Extended Backus Naur Formalism
EDI	Electronic Data Interchange
EGCS	Experimental/Enhanced GNU Compiler System
FHWA	Federal Highway Administration
flex	Tool for generating programs that perform pattern matching on text
FMS	Freeway Management System
FSF	Free Software Foundation
ftp	file transport protocol allows information to be copied through the Internet.
GCC	GNU Compiler Collection formerly GNU C Compiler
g++	GNU C++ Compiler
GNU	GNU's Not UNIX
GUI	Graphical User Interface
HCR	This server process caches HCR information and responds to client requests regarding changes to this information.
HCR Client	A client computer (PC) containing the proper software authorized to enter HCRS/RCRS information.
HCR GW	The HCR Gateway process accepts communication socket connections from authorized clients and routes their messages to other clients and servers.
HCR IVR	The process that periodically retrieves HCRS information and converts it to an IVR-compatible format.
HCR NWS	The HCR NWS process generates HCRS-compatible messages using the weather information retrieved by the NWS cron job. This information is forwarded to the HCR server through the HCR GW.
HCR WEB	The process that periodically retrieves HCRS information and converts it to an Internet/WEB-compatible format.

TERM	MEANING
HCRS	The Highway Condition Reporting System, also known as the Road Condition Reporting System, collects road condition information from authorized clients. This information, which includes scheduled and active closures, restrictions, etc., corresponds to highways and surface streets.
HTML	Hyper Text Markup Language
ICD	Interface Control Document
IDL	Interface Definition Language
IIOP	Internet Inter-ORB Protocol
ITS	Intelligent Transportation System
IVR	An Interactive Voice Response system answers telephone calls and provides synthesized-speech information requested by the caller via the touchpad or voice-recognition.
MCDOT	Maricopa County Department of Transportation
MDI	Model Deployment Initiative
MICO	MICO Is CORBA
MOF	Meta-Object Facility
NWS	The National Weather Service provides weather forecasts and advisories via its Internet web site.
OMA	Object Management Architecture
OMG	Object Management Group including 3Com, American Airlines, Canon, Data General, Hewlett-Packard, Philips Telecommunications, Sun Microsystems, Unisys
OOA	Object-oriented Architecture
OOL	Object-oriented Language, e.g., Java, C++, Smalltalk
ORB	Object Request Broker
POA	Portable Object Adapter
RADS	Regional Archived ITS Data System
RCRS	Road Condition Reporting System. Formerly known as the Roadway Closure and Restriction System, or the Highway Closure and Restriction System.
RCS	Revision Control System
RDBMS	Relational Database Management System
RFI	Request for Information
RPC	Remote Procedure Call or Remote Method Invocation
RWIS	Road Weather Information System
SAN	Storage Area Network
SGML	Standard Generalized Markup Language
SMART Corridor	AZTech™ arterial roadways instrumented for ITS traffic performance
TCS	Traffic Control System
TMC	Traffic Management Center
TOC	Traffic Operations Center
TPS	Traffic control signal Pattern Selection
UML	Unified Modeling Language is a graphical object modeling language to visualize, specify, construct and document a software system.
URL	Universal Resource Locator
VAR	Value Added Reseller
VMS	Variable Message Sign
VOS	Traffic flow variables of Volume, Occupancy, Speed
W3C	World Wide Web Consortium
WAN	Wide Area Network. Allow computers to connect to each other over a wide geographic region.
XMI	XML Metadata Interchange

TERM	MEANING
XML	Extensible Markup Language is a simplified subset of Standardized General Markup Language (SGML) that requires a browser to view the text and graphics. Unlike HTML’s fixed tags, XML has element definitions (see DTD). The strength of XML is its flexibility and its DTD subset definitions for specific domains. It is being promoted for electronic documentation and automated web-based transactions

CONTENTS

1 Introduction

In 1996, the Phoenix Metropolitan Area was awarded a Federal Highway Administration (FHWA) grant to assist in the integration of the region's Intelligent Transportation Systems (ITS). This Model Deployment Initiative (MDI) project, known as AZTech™, has combined the efforts of the Maricopa County Department of Transportation (MCDOT), the Arizona Department of Transportation (ADOT), nine Valley cities, Valley bus companies including Phoenix and Mesa Transit, and private industry to:

- *ease congestion*
- *alert drivers to delays,*
- *improve public transit operations and detail traffic conditions*.

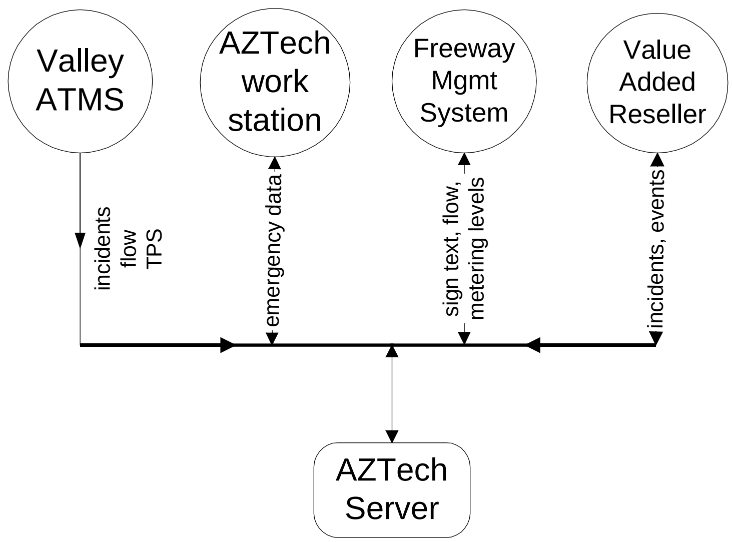
[AZTech™ Lessons Learned & Success Stories – April 1999]

The AZTech™ project has provided a system for the real-time collection and dissemination of transportation-related data. This information resides on the AZTech™ Data Server and is readily available to authorized clients. However, other potential users, such as transportation planners, traffic engineers, operating agencies, and the general public, do not have direct access to this collection of AZTech™ Data Server information. In fact, much resources are expended assembling traffic data for off-line citizen requests. Furthermore, not all of this data is currently being archived, and what is being archived is not available through the AZTech™ Data Server.

For example, the Cities of Tempe and Mesa have arterial roadways designated as SMART Corridors. Two of them, Southern Avenue and Baseline Road, are on either side of the Superstition Highway (US60). The municipalities have installed detectors along these SMART Corridors to provide arterial roadway performance data to the AZTech™ Server which provides the data to AZTech™ workstations, the ADOT Freeway Management System (FMS) and the AZTech™ Value Added Resellers (VARs). However, no where is there SMART Corridor historical data being saved.

2 AZTech™ System

The current comprehensive data source of traffic information in the Phoenix metropolitan area is located in the AZTech™ Server. The following is a summary of the various data currently being collected and disseminated.



AZTech™ Server

The Arizona Department of Transportation's Freeway Management System (FMS) provides information necessary for the real-time management of the instrumented portion of the Phoenix region freeways. The specific content and format of the messages provided by the FMS are defined in the **"FMS to AZTech™ Gateway Messaging with Events Document, December 19, 1997"**. The various type of information includes:

- Variable Message Sign
- Freeway Ramp Meter Signal
- Traffic Intersection Controller
- Traffic Detector Loop (Volume, Occupancy, Speed)
- Traffic Interchange Management

The Road Condition Reporting System was deployed by ADOT and collects state-wide highway and surface street information from various authorized clients. The specific content and format of the messages provided by the RCRS are defined in the **"RCRS Authorized Client Interface Control Document, Version 1.0, April 13, 1998"**. This data feed includes the following type of information:

- scheduled construction closures,
- permanent and temporary road restrictions,
- incidents and accidents,
- road conditions due to snow, ice or visibility,

- National Weather Service (NWS) forecasts and advisories for the State of Arizona.

Several cities have modified their Advanced Traffic Management Systems (ATMS) to exchange information with the AZTech™ workstation. The specific content and format of the messages provided are defined in the **"AZTech™ Signal Control System Interface Control Document, July 12, 2000"**. Several SMART Corridors or trans-jurisdictional arterial roadways have been selected for which the following information is available:

- Traffic Detector Loop (Volume, Occupancy, Speed)
- Traffic Intersection Controller events and alarms

However, none of this arterial roadway performance data is archived at present.

The Cities of Phoenix and Mesa Transit Systems provide real-time messages generated by Automated Vehicle Location (AVL) technology deployed on numerous buses. The specific content and format of the messages provided are defined in the **"AZTech™ ADS Interface Control Document, March 3, 1998"**. The various type of information includes:

- Schedule Adherence
- Bus Tracking

Value Added Resellers (VARs) have partnered with AZTech™ to exchange information via the Etak Server to the AZTech™ workstation. The specific content and format of the messages provided are defined in the **"AZTech™ Signal Control System Interface Control Document, July 12, 2000"**. Several SMART corridors have been selected for which the following information is available:

- Traffic Detector Loop (Volume, Occupancy, Speed)
- Traffic Intersection Controller events and alarms

In addition to the data listed above, the AZTech™ workstations allow for various clients to exchange information. The specific content and format of the messages are defined in the **"AZTech™ Workstation User's Guide, April 9, 1999"**. The type of information includes:

- Video Signal and Camera Control requests originating from any of the AZTech™ Workstations.
- Incidents reported through the Metro Network Graphical User's Interface (GUI).
- Incidents extracted from the City of Phoenix Fire Department computer.

There is no AZTech™ archive, per se. FMS and RCRS keep separate archival databases that are isolated.

3 Mission Statement

The Mission of the Data Spooler/Loggert is:

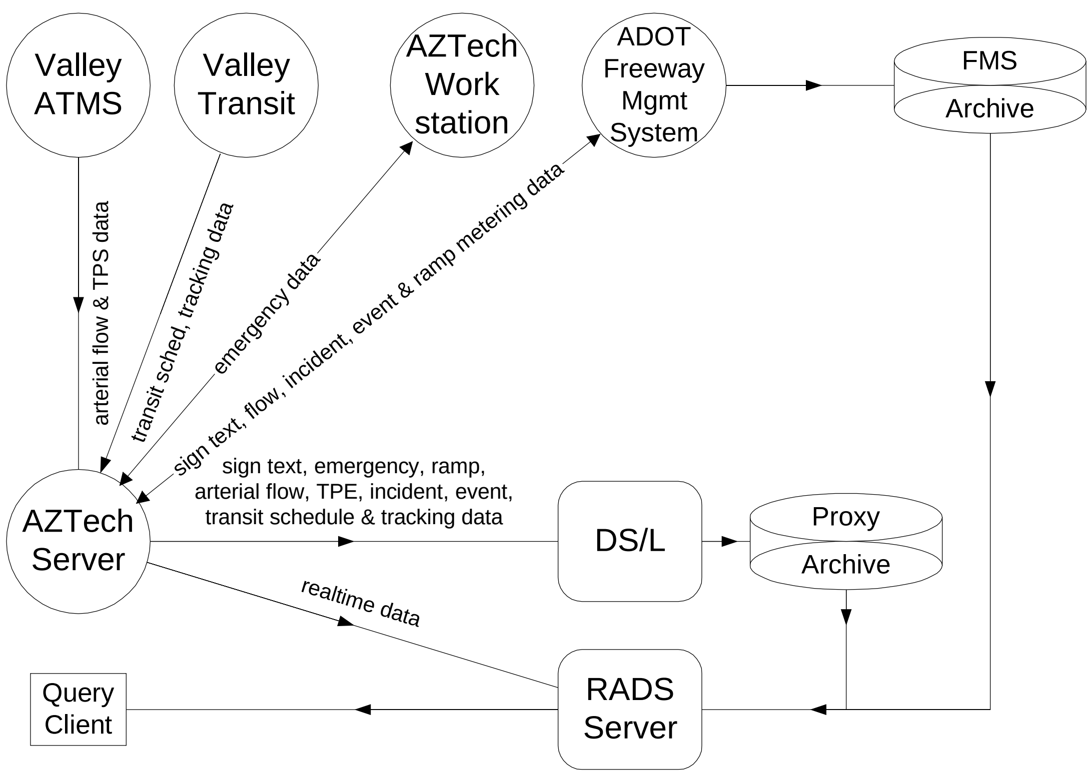
> To collect the distinct data feeds provided by the AZTech™ Server and archive the data for those components that do not have such aggregation facility.

4 Functional Analysis

The nucleus of the Regional Archival Data System (RADS) is the RADS Server that provides access to AZTech™ realtime data and FMS Historical Data for the Query Client. The Data Spooler/Logger (DS/L) will serve as the data archiver for those components of RADS that do not have such a aggregation facility. The DS/L will collect the distinct data feeds provided by the AZTech™ Server as described in the Interface Control Document (ICD) into a Proxy Archive. Duplication of data should be kept at a minimum to reduce the need for updating synchronization. A Web-based Graphical User Interface that allows different levels of authorization to access appropriate traffic information would eliminate a need for a publishing/distribution infrastructure. This interface should provide a single, seamless, consistent front-end format for the Query Client. It will comply with the National Traffic Management Data Dictionary (TMDD) to insure a uniform vocabulary.

4.1 Data Flow Diagram (DFD)

The following top level data flow diagram summarizes the context within which the DS/L operates. It shows various external entities that the DS/L interacts with in the course of doing business, and the data exchanged with each. There are different external entities (which are not shown in the diagram) that feed their information into the AZTech™ Server; their data flows are labelled.



Finally, the RADS Server interfaces the Query Client with both the realtime and historical data.

4.2 Common Object Request Broker Architecture

What is the “glue” that will interface these new modules, DS/L and the RADS Server, to the existing AZTech™ components as well as the Query Client? Computran feels that the Common Object Request Broker Architecture (CORBA) offers the most flexible means to deal with existing AZTech™ components as well as legacy and future interface issues. It provides a complete distributed messaging and runtime environment.

The definition of CORBA, according to the Object Management Group (OMG) is the following:

"The Common Object Request Broker Architecture (CORBA), is the Object Management Group's answer to the need for interoperability among the rapidly proliferating number of hardware and software products available today. Simply stated, CORBA allows applications to communicate with one another no matter where they are located or who has designed them. CORBA 1.1 was introduced in 1991 by the Object Management Group (OMG) and defined the Interface Definition Language (IDL) and the Application Programming Interfaces (API) that enable client/server object interaction within a specific implementation of an Object Request Broker (ORB). CORBA 2.0, adopted in December of 1994, defines true interoperability by specifying how ORBs from different vendors can interoperate.

The ORB is the middleware that establishes the client-server relationships between objects. Using an ORB, a client can transparently invoke a method on a server object, which can be on the same machine or across a network. The ORB intercepts the call and is responsible for finding an object that can implement the request, pass it the parameters, invoke its method, and return the results. The client does not have to be aware of where the object is located, its programming language, its operating system, or any other system aspects that are not part of an object's interface. In so doing, the ORB provides interoperability between applications on different machines in heterogeneous distributed environments and seamlessly interconnects multiple object systems."

AZTech™ is a growing and evolving entity that will face the challenges of parking management, Commercial Vehicle Operation (CVO), Road Weather Information Systems (RWIS), roadway feature inventory, in a distributed computing environment of disparate computers and operating systems, especially if the trend of utilizing Commercially Off The Shelf (COTS) CORBA-compliant applications continues.

Because CORBA complies with the National ITS Architecture and is loosely coupled, no one component should disable the rest of the system. And while a distributed system “divides and conquers”, there is the human challenge of coordinating the administration of multiple data stores. The ownership and security of each RADS component must not be compromised.

There are a number of CORBA vendors of Object Request Brokers (ORB) software, some of which are listed below:

VENDOR	URL
Morgan Kaufman Publishers/MICO	www.mkp.com/books_catalog/catalog.asp?ISBN=1-55860-666-1
Inprise/Borland VisiBroker	www.borland.com/visibroker/
Iona Orbix	www.iona.com
Rogue Wave Nouveau	www.roguewave.com/products/middleware/
ObjectSpace Voyager	www.objectspace.com/products/vgrOverview.htm
Powerbroker	www.expersoft.com/
Objectbroker and Iceberg	www.beasys.com/
DAIS ORB	www.icl.co.uk/dais/home.html

VENDOR	URL
IBM Component Broker	www.software.ibm.com/ad/cb/
Java IDL	www.javasoft.com/
Object Oriented Concepts OmniBroker	www.ooc.com/

The ORB Core software handles all the communications between objects within a distributed object system. The ORB accepts requests from clients, locates and activates the target objects, and forwards the requests. The key to the language and platform independence is the Interface Definition Language (IDL) that ultimately describes the objects, without getting involved with internal machinations and representations of other applications. The ORB also provides basic default services, such as security, naming, firewall support, distributed processing, scalability, transaction and persistence services, etc. There are also facilities for communicating with non-CORBA components.

There are some pre-compilers that can process an Object Oriented Language (OOL) source unit and generate IDL. Borland's JBuilder has a Data Modeler that can construct SQL queries against a remote database and save them as IDL modules. The most convincing CORBA endorsement is the fact that it is the most widely deployed and actively used middleware product because it is part of Netscape's Communicator browser.

4.3 Future Data Sources

The following data sources are suggested for future inclusion in a regional data archive for public dissemination.

CORBA-based Valley ATMS

It is understood that several Valley jurisdictions are updating their Advanced Traffic Management Systems (ATMS) with CORBA-compliant systems which could provide:

- flow data of the all instrumented arterials.
- Traffic control signal Pattern Selection (TPS).

ADOT Freeway Management System

In addition to the realtime snapshots that are funneled to the AZTech™ Server, the Freeway Management System (FMS) also archives its processed data:

- Averaged freeway flow (volume, occupancy, speed).
- Averaged truck counts.
- Freeway flow per lane.
- Smoothed flow per lane
- Incident data.
- Ramp metering raw data for every five minute period of the day for the last 24 hours.
- Summary of ramp metering.
- Exponentially smoothed data for every five minutes for every day of the week for every ramp meter.
- Road condition change history.

Accident Location Identification & Surveillance System

ADOT maintains a network accessible database of accident information in its Accident Location Identification and Surveillance System (ALISS) that includes:

- DPS and local police accident report data.

This was identified as providing “much of the incident crash data that Emergency Services personnel require” [MCDOT’s Scalable AZTech™ Data Server Enhancements for Planning and Operations: User Services Requirements Study October 14, 1999].

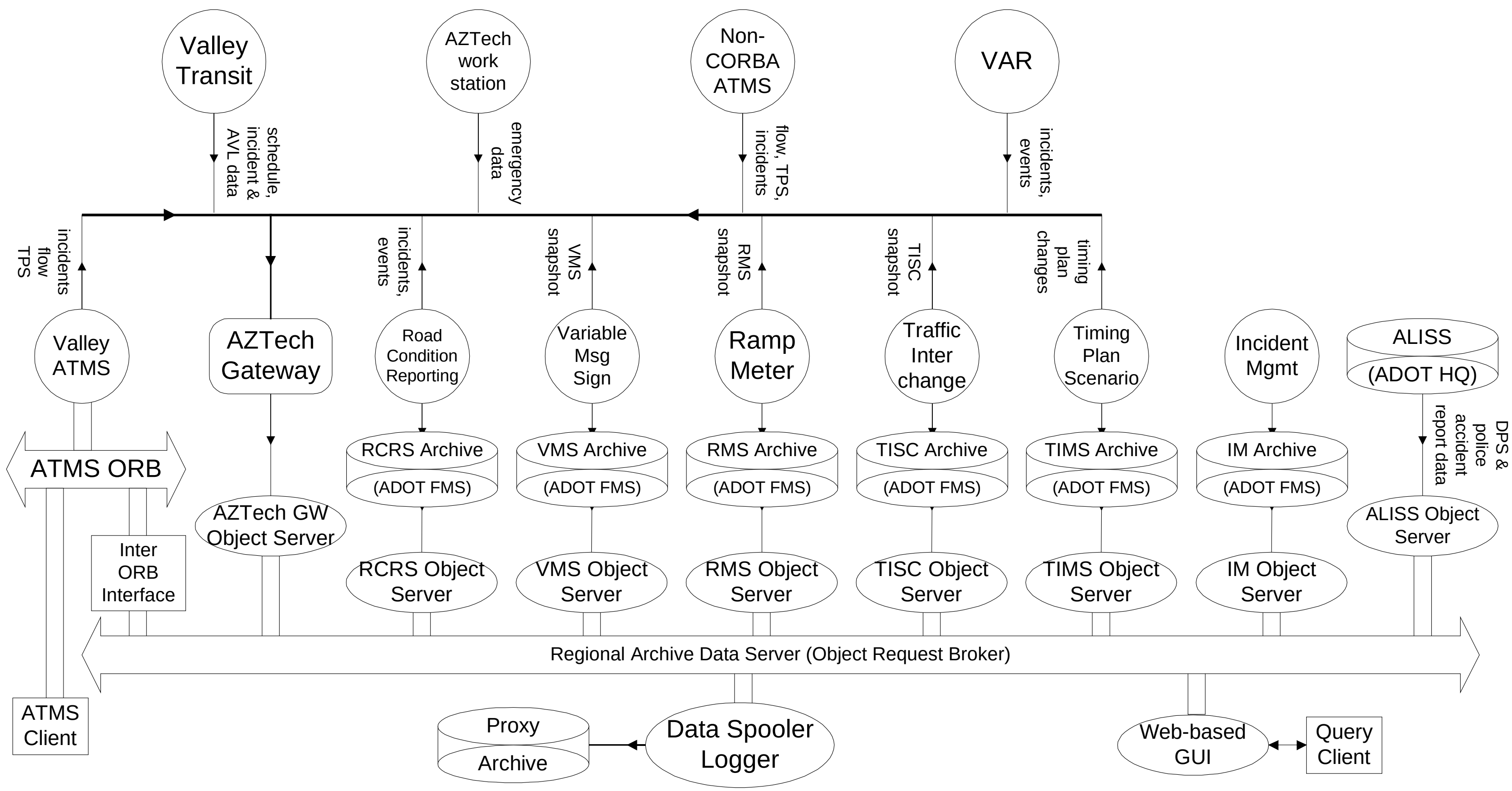
4.4 System Diagram

In the following CORBA-based diagram depicting the paths between Datastores and Query Client, the Object Servers perform the datastore access of the RADS archives, while the Web-based Graphical User Interface (GUI) converts Query Client input to CORBA requests in a secured environment. Upon receipt of the data, it will present the response to the user.

MCDOT

<u>Regional Archive ITS Data System</u>

RADS



Note that AZTech™ data sources such as the Road Condition Reporting System archives data that is not available to the AZTech™ Server, and ADOT data sources such as Incident Management archives data that is currently only available to the Freeway Management System (FMS).

The ATMS and RADS Object Request Brokers (ORBs) communicate using the Internet InterORB Protocol (IIOP), the standard communication protocol between ORBs.

4.5 Summary of Data

The following table lists the various data currently available in the FMS/AZTech™ network and their relative sizes:

DATA ORIGIN	FIELD DEVICE	DATA FREQ	STORE FREQ	DATA TYPE	SIZE (bytes)	ARCHIVAL CYCLE	APPROX ANNUAL STORAGE (Mbytes)
ADOT FMS	Detector	20 secs	1 minute	format 1 feedback	67	1 yr	105.65
		20 secs	1 minute	snapshot*	180,000	1 yr	283,824.00
		5 mins	5 mins	averaged VOS	17	1 yr	3,216.67
		5 mins	5 mins	averaged truck count	13	90 da	6.74
		5 mins	5 mins	VOS per lane	17	90 da	264.38
		5 mins	5 mins	smoothed VOS per lane	16	1 yr	22,295.35
ADOT FMS	Incident	as occurs	as occurs	incident info	331	unlimited	0
ADOT FMS	Ramp Meter	20 secs	1 minute	format 1 feedback	19	1 yr	52.53
		20 secs	1 minute	snapshot*	27	1 yr	127.18
		5 mins	5 mins	summary per month	23	30 da	4.98
		5 mins	5 mins	raw per day	27	24 hrs	12.90
		5 mins	5 mins	exponential per week	10	7 da	0.02
ADOT FMS	Road Condition Reporting	as occurs	as occurs	event	1646	unlimited	0
				event change	1646	unlimited	0
ADOT FMS	Traffic Interchange Mgmt	as occurs	as occurs	timing plan change scenario*	28,859		0
ADOT FMS	Traffic Interchange	20 secs	1 minute	format 1 feedback	28	1 yr	44.15
		20 secs	1 minute	snapshot*	40	1 yr	63.07
ADOT FMS	Variable Msg Sign	20 secs	1 minute	format 1 feedback	11	1 yr	2.09
		20 secs	1 minute	snapshot*	235	1 yr	370.55
Local jurisdiction	Traffic Signal	20 secs	1 minute	arterial VOS*	67	1 yr	105.65
				signal phasing*	48		0
Transit	FMDS	1-2 mins	1-2 mins	transit usage*	42+3 strings		0
				transit schedule adherence*	47		

* via AZTech™ Server

4.6 Summary of CORBA Development Process

The following are typical steps in implementing a CORBA application:

- Select, purchase and install a Commercially Off-The-Shelf (COTS) CORBA development environment including support function library, IDL compilers, and OOL, e.g., Java, C++, SmallTalk.
- Develop requirements, using Universal Modeling Language (UML) to model data, objects and operations.
- Design interface to objects identified in the previous step using IDL.
- Generate interface stubs to create proxy objects and skeletal code to access objects that support the interfaces (IDL compilation).
- Identify interfaces and classes that need to be utilized, and enhancements to Remote Procedure Calls (RPC) that need to be developed.
- Develop application-specific ORB initialization code using an OOL, e.g., Java, C++, SmallTalk.
- Configure CORBA objects.
- Compile and integrate application-specific and generated code, COTS services and CORBA.

5 Implementation

Implementation should begin by acquiring a development system as outlined in the Section 6, and then building the RADS ORB.

5.1 Proof of Design/Concept

To test the inter-agency and security issues, Computran suggests a multi phase approach to the initial implementation:

1. develop the RCRS Object Server to connect the existing RCRS change history to the ORB
2. implement the Web-based GUI for the RCRS change history
3. implement the DS/L and Proxy Archive
4. expand the Web-based GUI to accommodate the Proxy Archive

5.2 Final Implementation

The final implementation will involve developing:

- ATMS ORB
- Object Servers for the other RADS components
- expanded Query Client for the other RADS Archives

6 Environment Requirements

Environmental characteristics cover the requirements governing the platform hardware, peripherals, operating systems, software tools, database software, and training. The *Development Environment* refers to the resources necessary to develop the application, while the *Maintenance Environment* refers to the resources with which the application will be maintained (bug fixes) and enhanced for future data sources. Computran recommends using tape backup for the development system due to the large volumes of data expected. The guidelines for these environments should minimize cost at the expense of reliability and speed.

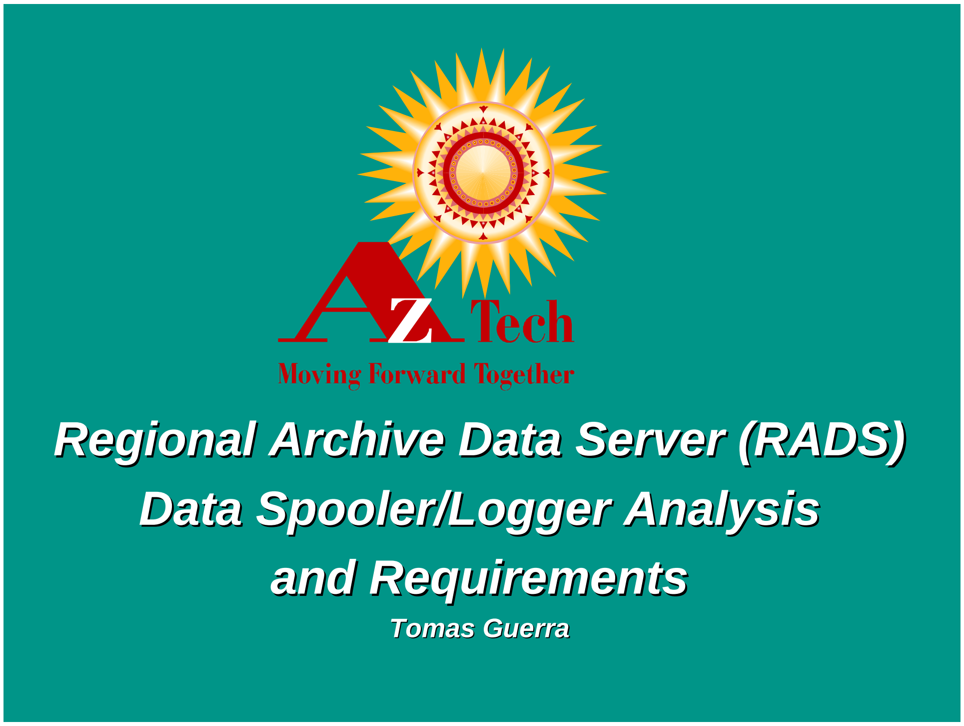
DEVELOPMENT/MAINTENANCE ENVIRONMENT	**COST**
Pentium PC/Windows NT Server[1]	$34,583
Network Connection	5,000
C++ compiler	5,000
UML Toolkit	1,000
CORBA Development License	2,500
CORBA Web Development License	2,500
CORBA Support License	400/yr
CORBA Training	2,000

[1] see Appendix F for configuration details

The *Production Environment* refers to the resources upon which the production application executes. The criteria for this platform includes high availability and speed. This may be accomplished using fault tolerant techniques, data replication, data storage mirroring. Note that the production system can still operate as development continues on the maintenance system.

PRODUCTION ENVIRONMENT	**COST**
Sun E450 Server[2]	$134,405
Network Connection	5,000
CORBA Runtime License	100

[2] see Appendix G for configuration details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AGENDA

- Mission of RADS and DS/L
- RADS and DS/L within AZTech™
- National Standards
- Implementation Approach
- Questions?

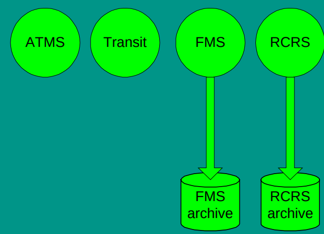
Regional Archive Data Server (RADS) Mission Statement

To provide and maintain valid, classified ITS-derived data for use in system planning, modeling, and real-time operation applications.

Data Spooler/Logger (DS/L) Mission Statement

To collect the distinct data feeds provided by the AZTech™ Server and archive the data for those components that do not have such aggregation facility.

Before AZTech™



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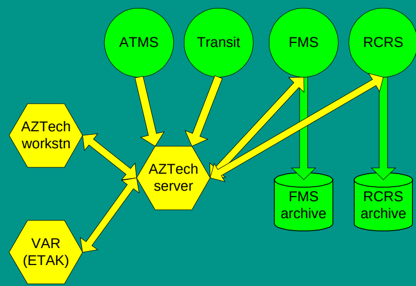
After AZTech™



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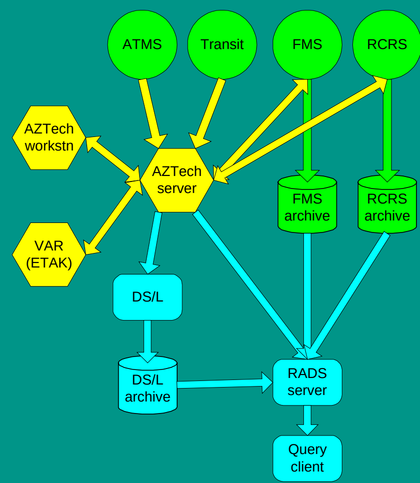
AZTech™, DS/L and RADS



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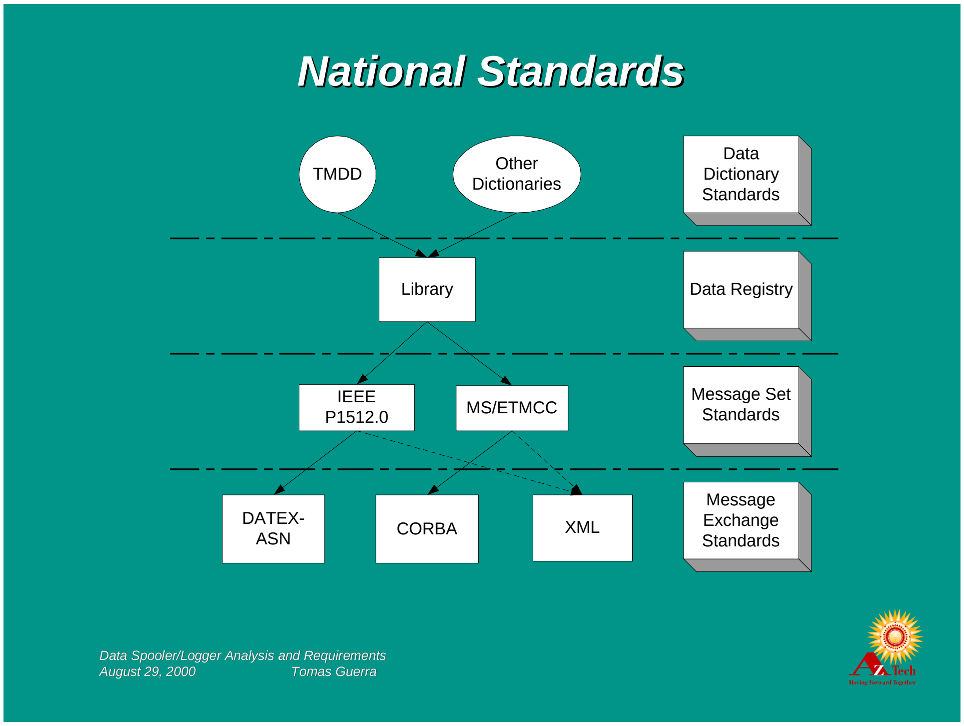
National Standards
TMDD
Other Dictionaries
Data Dictionary Standards
Library
Data Registry
IEEE P1512.0
MS/ETMCC
Message Set Standards
DATEX-ASN
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XML
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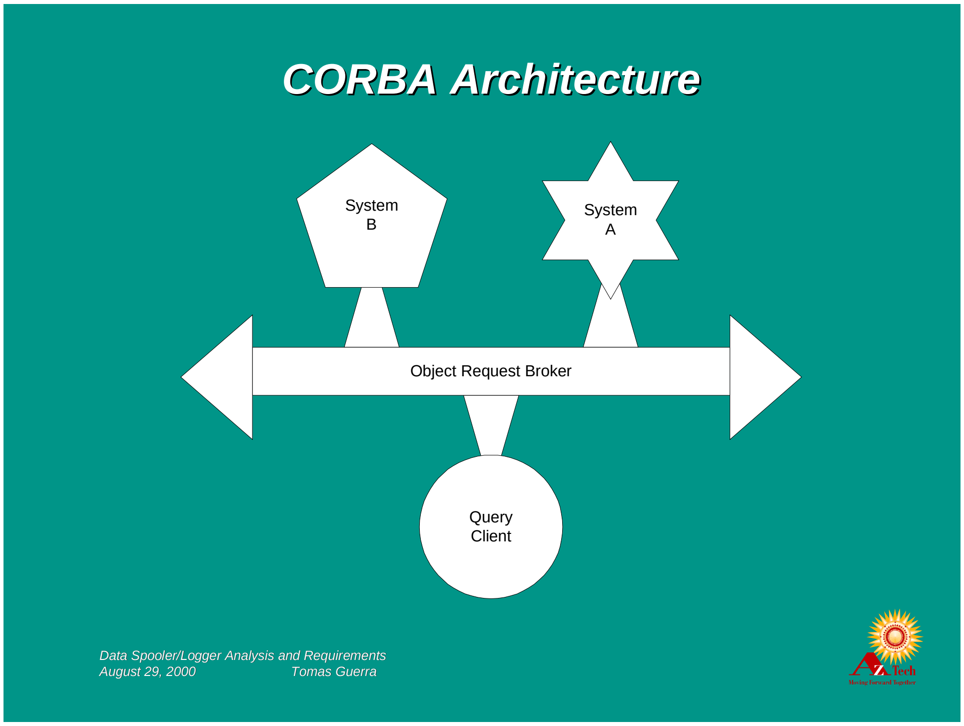
CORBA - the "glue"

The Common Object Request Broker Architecture allows applications to communicate with one another no matter where they are located or who has designed them.


CORBA Architecture
System
B
System
A
Object Request Broker
Query
Client
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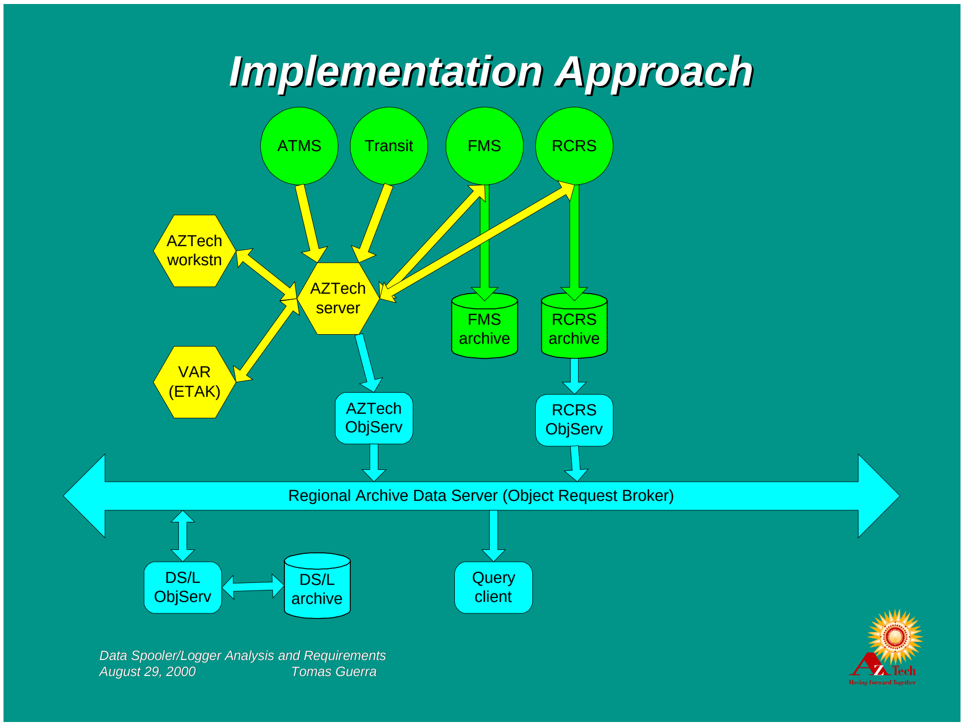
Implementation Approach
ATMS
Transit
FMS
RCRS
AZTech workstn
AZTech server
VAR (ETAK)
FMS archive
RCRS archive
AZTech ObjServ
RCRS ObjServ
Regional Archive Data Server (Object Request Broker)
DS/L ObjServ
DS/L archive
Query client
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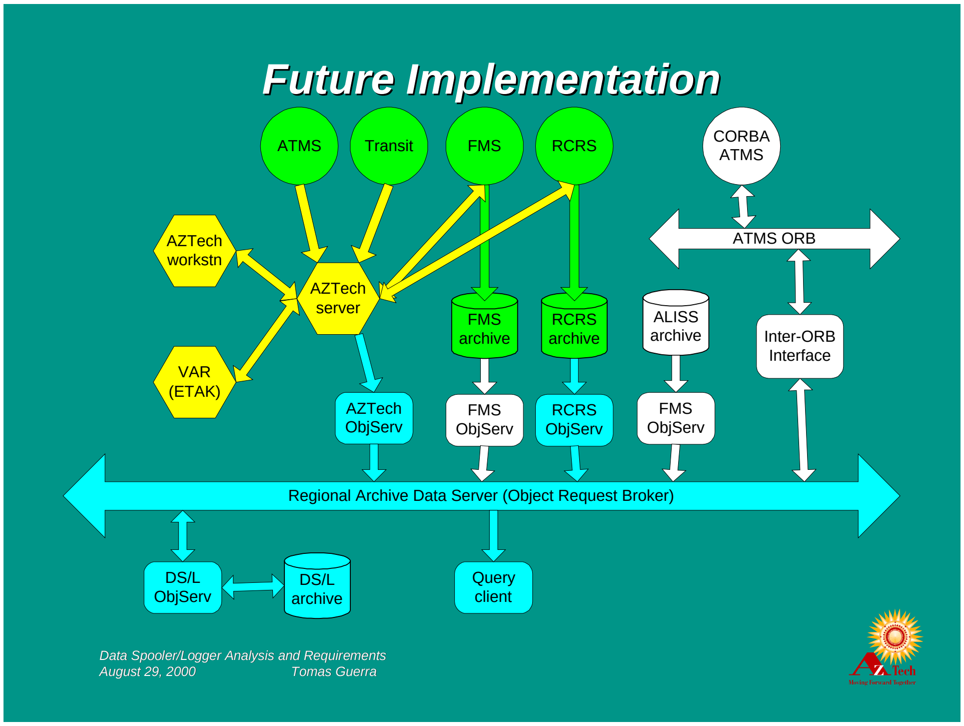
Future Implementation
ATMS
Transit
FMS
RCRS
CORBA ATMS
ATMS ORB
AZTech workstn
AZTech server
VAR (ETAK)
FMS archive
RCRS archive
ALISS archive
Inter-ORB Interface
AZTech ObjServ
FMS ObjServ
RCRS ObjServ
FMS ObjServ
Regional Archive Data Server (Object Request Broker)
DS/L ObjServ
DS/L archive
Query client
Data Spooler/Logger Analysis and Requirements
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Appendix B   Bibliography

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15. Object Management Group, Inc. 1997-2000. *CORBA and XML; conflict or cooperation?*
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20. Orfali, Robert, Dan Harkey. March 1998. *Client/Server Programming with Java and CORBA*.
21. Elenko, Mark, David Clarke. 2000. *CORBA & XML—Hit or Miss?*

Appendix C Correspondence

Subject:
CORBA contacts
Date:
Wed, 02 Aug 2000 12:09:50 -0700
From:
DavidKelley@socketcity.com (David Kelley)
To:
"Tomas Guerra"<computran@inficad.com>

Here is the contact data for CORBA implementors we talked about:

Les Jacobson
PB Farradyne
999 Third Avenue, Suite 2200
Seattle, WA 98104
(206) 382-5290
Fax: (206) 382-5222
e-mail: jacobsonl@pbworld.com

Steve Dellenback
Software Engineering Department
Southwest Research Institute
Voice: (210) 522-3914
FAX: (210) 522-5885
"Steve Dellenback"<SDellenback@swri.edu>

Regards, David Kelley
ITS Programs Development 626-915-4488 Phone
SubCarrier Systems Corp. 626-915-3168 Fax

Subject:
RE: CORBA/ITIS
Date:
Wed, 2 Aug 2000 16:31:13 -0500
From:
"Steven W. Dellenback" <sdellenback@swri.org>
To:
"Tomas Guerra" <computran@inficad.com>

Tomas:

I would be happy to "e-mail" or "talk" to you but two things:

- We are not using CORBA at all (for our TMDD implementation)
- I will be out of the office on Thurs/Friday of this week...

Let me know if you still want to talk....

SWD

-
Steve Dellenback
Software Engineering Department
Southwest Research Institute
Voice: (210) 522-3914
FAX: (210) 522-5499

-----Original Message-----
From: Tomas Guerra [mailto:computran@inficad.com]
Sent: Wednesday, August 02, 2000 3:10 PM
To: Steve Dellenback; David Kelley
Subject: CORBA/ITIS

Mr. Dellenback,

My name is Tomas Guerra, and I was chatting with David Kelley earlier today regarding the Revised ITIS List.

During the course of our discussions we talked about CORBA, XML, NTCIP, TMDD, and "all things standards". David mentioned that you had extensive experience with deploying TMDD using CORBA. I was intrigued by this, as this is a consideration being undertaken here by Arizona DOT.

I would like to spend some time talking, or e-mailing, with you to learn about your experiences and thoughts regarding this topic.

Thank you for your consideration.

Tomas Guerra
(602) 252-0385

Subject:
RE: TMDD
Date:
Thu, 31 Aug 2000 12:21:34 -0500
From:
"Steven W. Dellenback" <sdellenback@swri.org>
To:
"Tomas Guerra" <computran@inficad.com>

Tomas:

His name is Scott Melby and he works for PBFI in Rockville, Maryland.
Contact info is:

e-mail: melby@pbworld.com

SWD

-
Steve Dellenback
Software Engineering Department
Southwest Research Institute
Voice: (210) 522-3914
FAX: (210) 522-5499

-----Original Message-----
From: Tomas Guerra [mailto:computran@inficad.com]
Sent: Monday, August 28, 2000 12:41 PM
To: Steve Dellenback
Subject: TMDD

Steve,

It was a pleasure meeting with you last week. Thank you for taking the time to chat. As we discussed, you have a CORBA contact whose Outlook information you would like to forward to me. I think you said his name is Scott....

Thanks again for your help.

Tomas Guerra
(602) 252-0385

Subject:
RE: TMDD and CORBA
Date:
Fri, 1 Sep 2000 09:03:33 -0400
From:
"Melby, Scott" <Melby@pbworld.com>
To:
"'Tomas Guerra'" <computran@inficad.com>

Tomas -

It's true, I am implementing a CORBA based system for the Maryland CHART program. Unfortunately, trying to implement the TMDD in CORBA is a tricky business right now. The TMDD is not very object oriented... so a translation into IDL is necessary. Since I have a project to do, my team has done a translation ahead of the standards. However, there are bound to be differences between our interpretation and that of the standards committee. The NTCIP Center to Center committee is currently working on this very issue. The best person to contact is Ken Vaughn at Iteris, as they are currently contracted to develop the IDL model for the TMDD. Let me know if you have further questions.

Hope this helps
Scott

-----Original Message-----
From: Tomas Guerra [mailto:computran@inficad.com]
Sent: Thursday, August 31, 2000 6:34 PM
To: Melby, Scott
Subject: TMDD and CORBA

Mr. Melby,

My name is Tomas Guerra, and I was chatting with Steve Dellenback last week at the TMDD meeting in Denver.

During the course of our discussion we talked about CORBA, XML, NTCIP, TMDD, and "all things standards". David mentioned that you had extensive experience with deploying TMDD using CORBA. I was intrigued by this, as this is a consideration being undertaken here by Arizona DOT.

I would like to spend some time talking, or e-mailing, with you to learn about your experiences and thoughts regarding this topic.

Thank you for your consideration.

Tomas Guerra
(602) 252-0385

Appendix D TMDD Meeting

Joint SAE-ATIS/ITE-TMDD Meeting

August 24, 2000
Denver, Colorado

The meeting agenda was extensive and covered issues such as:

- TMDD/ATIS coordination
- ITIS code list standardization
- Message set for external TMC communications

There are numerous areas where the standards work in progress may be reviewed. These locations are unofficial, but contain the latest information:

www.tmdd.org or www.ite.org.tmdd
www.nema.org
www.ntcip.org

I will be signing up for the list servers on these sites to participate in the discussions.

The basic points that I extracted from the meeting are summarized below.

TMDD:
Traffic Management Data Dictionary defines the comprehensive list of data elements that can be used by ITS systems that have the function of traffic management. It may be thought of as the list of valid words that may be spoken by any compliant system. There are numerous efforts under way to establish this list of elements. At this point, the Data Dictionary is in solid shape. One should think twice before using a data element that is not already defined in the Data Dictionary.

Message Sets:
Define how various elements from the data dictionary may be put together to exchange information. These may be thought of as sentences that contain words using an accepted syntax and form. There are numerous efforts under way to define message sets including **IEEE P1512.0 - Common Incident Management Message Sets for use by Emergency Management Centers** and **TM2.01 – Message Sets for External Traffic Management Center Communications (MS/ETMCC)**. Final definition of these message sets will take a while to complete. Within a given set, a lot of flexibility is provided for optional fields to be added. It is likely that several message sets will be defined and co-exist. Message sets are documented using Abstract Syntax Notation One (ASN.1).

Exchanging Data:
Once it has been decided which message sets are to be used for exchanging information, there are various ways to do so. The prominent ways being discussed are DATEX, CORBA and XML, each with its advantages and disadvantages.

Given the flexibility provided by the still-converging standards, it is interesting to consider how "standards compliance" will be judged. Several approaches were discussed in the meeting:

Do nothing:
Although new systems will not be provided with this option, many legacy systems will continue to survive as is. It is only when they need to exchange information with other systems do the issues of compliance become a factor.

Build from the ground up:
It would be ideal if a new system used the data dictionary when defining its internal data elements and database schema. Additionally, this ideal system would use only valid message sets to communicate internally between its processes.

Apply a shield:
Although a system should make maximum use of the standards, there is no requirement that its internal schema be compliant. Therefore, the approach of "applying a shield" to a system (that is, making it send and receive valid message sets in an accepted manner) is ideal for legacy systems. This approach allows the internals of a system to remain intact while appearing to be compliant to the rest of the world.

This final option reinforces what we've discussed regarding the Data Spooler Logger and future AZTech™ systems integration options. This approach allows the systems to continue to operate while phasing in appropriate message sets at opportune times. Steve Dellenback (Southwest Research Institute) stated (informally) that about $500 thousand were spent in Texas to apply shields to one of their legacy systems.

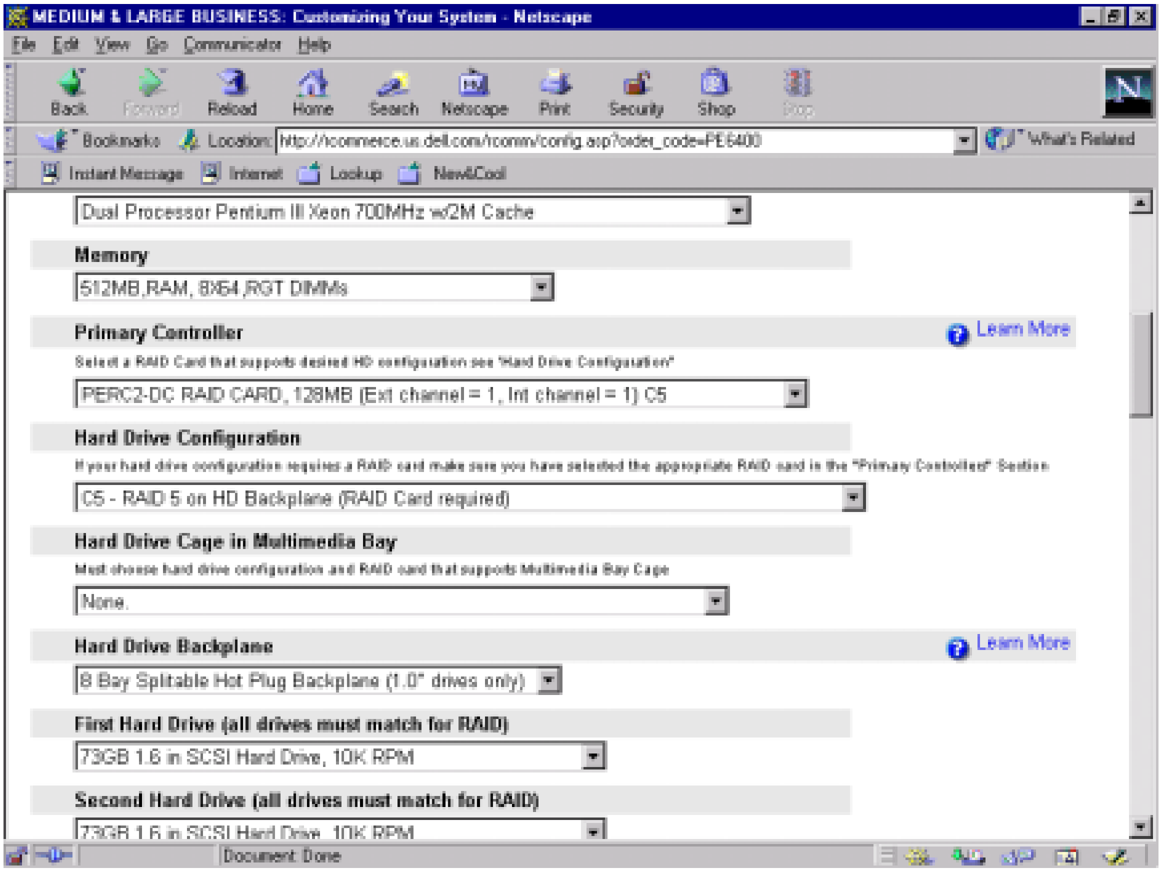
The next meeting will be October 26 and 27:
Hotel St. Marie
827 Toulouse Street
New Orleans, LA 70112
(800) 366-2743

Appendix E CORBA vs XML

In their article, *CORBA & XML—Hit or Miss?* in XML Journal.com, Mark Elenko and David Clarke state:

CORBA is a fully featured, stateful, quality-of-service-rich distributed runtime environment; XML is a means of describing document structure. XML is about structure; CORBA is about infrastructure. People talk about building their systems on CORBA in a way that's not meaningful for XML. If you have an XML document and want to transport it somewhere, it's necessary to appeal to other distributed techniques such as CORBA.

Appendix F Development Environment


MEDIUM & LARGE BUSINESS: Customizing Your System - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location: http://commerce.us.dell.com/commerce/config.asp?order_code=PE6400
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Instant Message Internet Lookup New&Cool
Dual Processor Pentium III Xeon 700MHz w/2M Cache
Memory
512MB,RAM, 8X64,RGT DIMMs
Primary Controller
Learn More
Select a RAID Card that supports desired HD configuration see "Hard Drive Configuration"
PERC2-DC RAID CARD, 128MB (Ext channel = 1, Int channel = 1) C5
Hard Drive Configuration
If your hard drive configuration requires a RAID card make sure you have selected the appropriate RAID card in the "Primary Controller" Section
C5 - RAID 5 on HD Backplane (RAID Card required)
Hard Drive Cage in Multimedia Bay
Must choose hard drive configuration and RAID card that supports Multimedia Bay Cage
None.
Hard Drive Backplane
Learn More
8 Bay Splitable Hot Plug Backplane (1.0" drives only)
First Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Second Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
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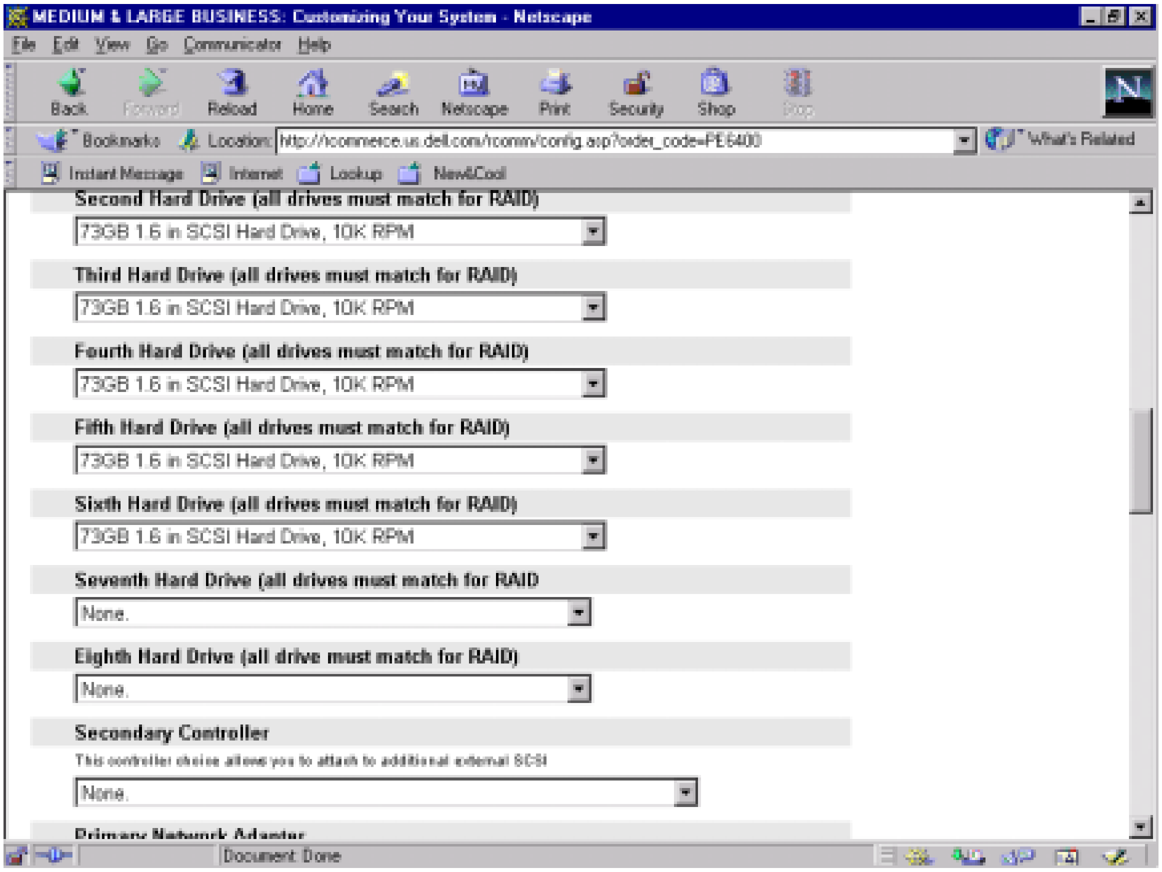
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File Edit View Go Communicator Help
Back
Forward
Reload
Home
Search
Netscape
Print
Security
Shop
Stop
Bookmarks
Location: http://commerce.us.dell.com/tcomm/config.asp?order_code=PE6400
What's Related
Instant Message
Internet
Lookup
New&Cool
Second Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Third Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Fourth Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Fifth Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Sixth Hard Drive (all drives must match for RAID)
73GB 1.6 in SCSI Hard Drive, 10K RPM
Seventh Hard Drive (all drives must match for RAID
None.
Eighth Hard Drive (all drive must match for RAID)
None.
Secondary Controller
This controller choice allows you to attach to additional external SCSI
None.
Primary Network Adapter
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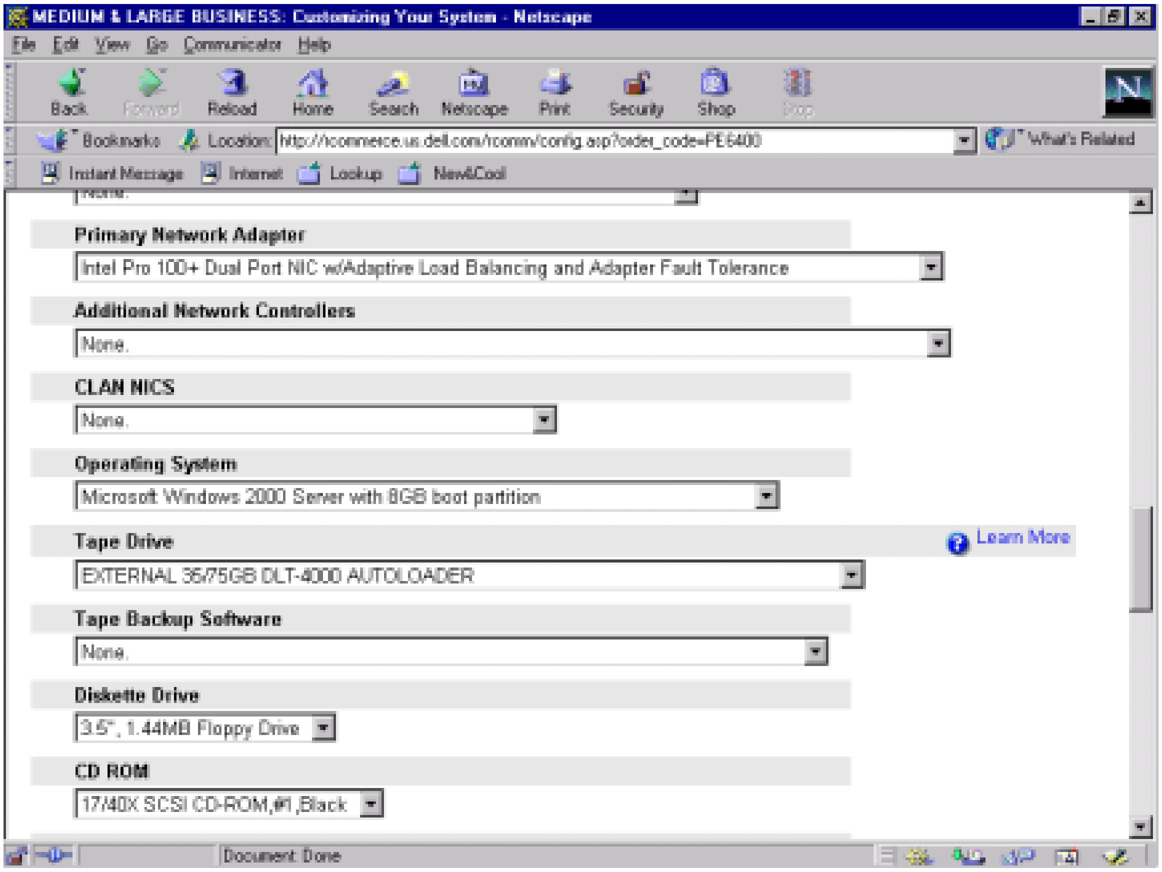
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File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location: http://commerce.us.dell.com/comm/config.asp?order_code=PE6400
What's Related
Instant Message Internet Lookup New&Cool
Primary Network Adapter
Intel Pro 100+ Dual Port NIC w/Adaptive Load Balancing and Adapter Fault Tolerance
Additional Network Controllers
None.
CLAN NICS
None.
Operating System
Microsoft Windows 2000 Server with 8GB boot partition
Tape Drive
Learn More
EXTERNAL 35/75GB DLT-4000 AUTOLOADER
Tape Backup Software
None.
Diskette Drive
3.5", 1.44MB Floppy Drive
CD ROM
17/40X SCSI CD-ROM,#1,Black
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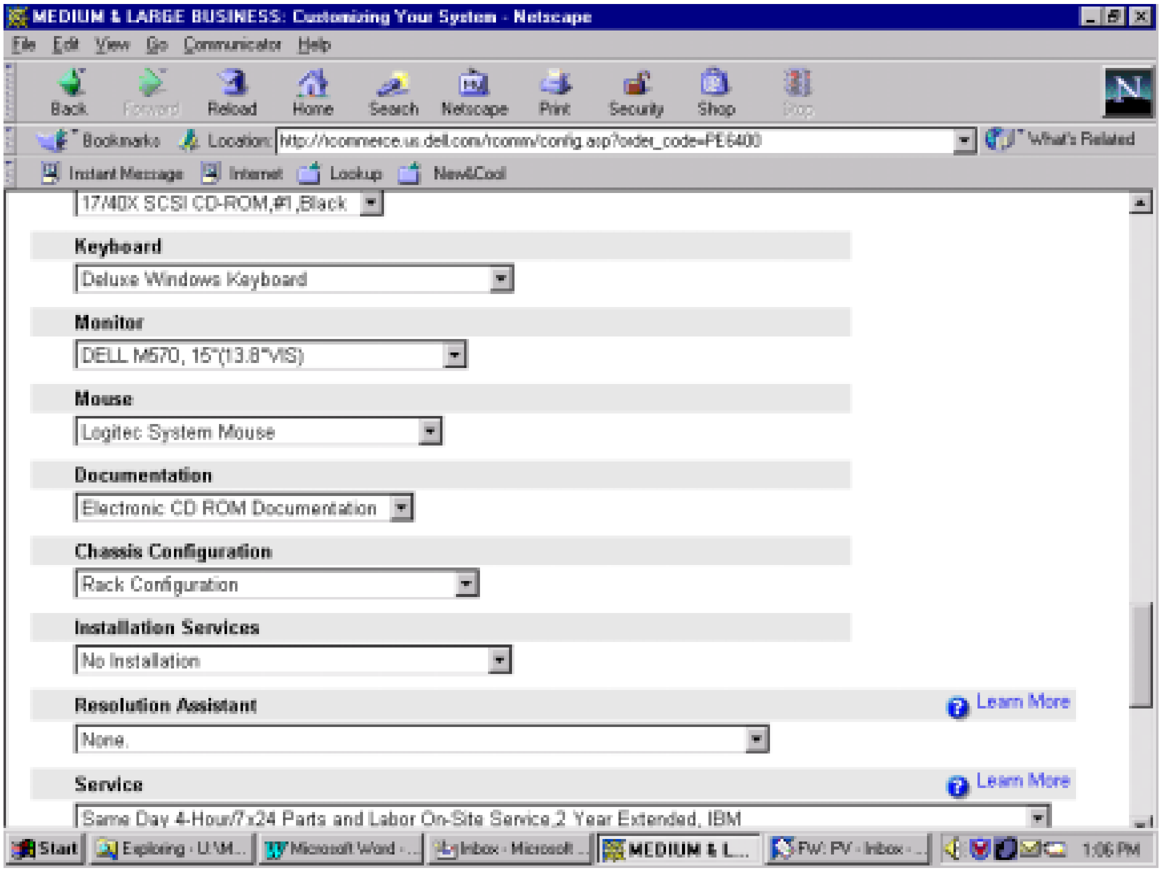
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File Edit View Go Communicator Help
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Netscape
Print
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Shop
Stop
Bookmarks
Location: http://commerce.us.dell.com/dellstore/config.asp?order_code=PE6400
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DELL M570, 15"(13.8"VIS)
Mouse
Logitec System Mouse
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Electronic CD ROM Documentation
Chassis Configuration
Rack Configuration
Installation Services
No Installation
Resolution Assistant
Learn More
None.
Service
Learn More
Same Day 4-Hour/7x24 Parts and Labor On-Site Service,2 Year Extended, IBM
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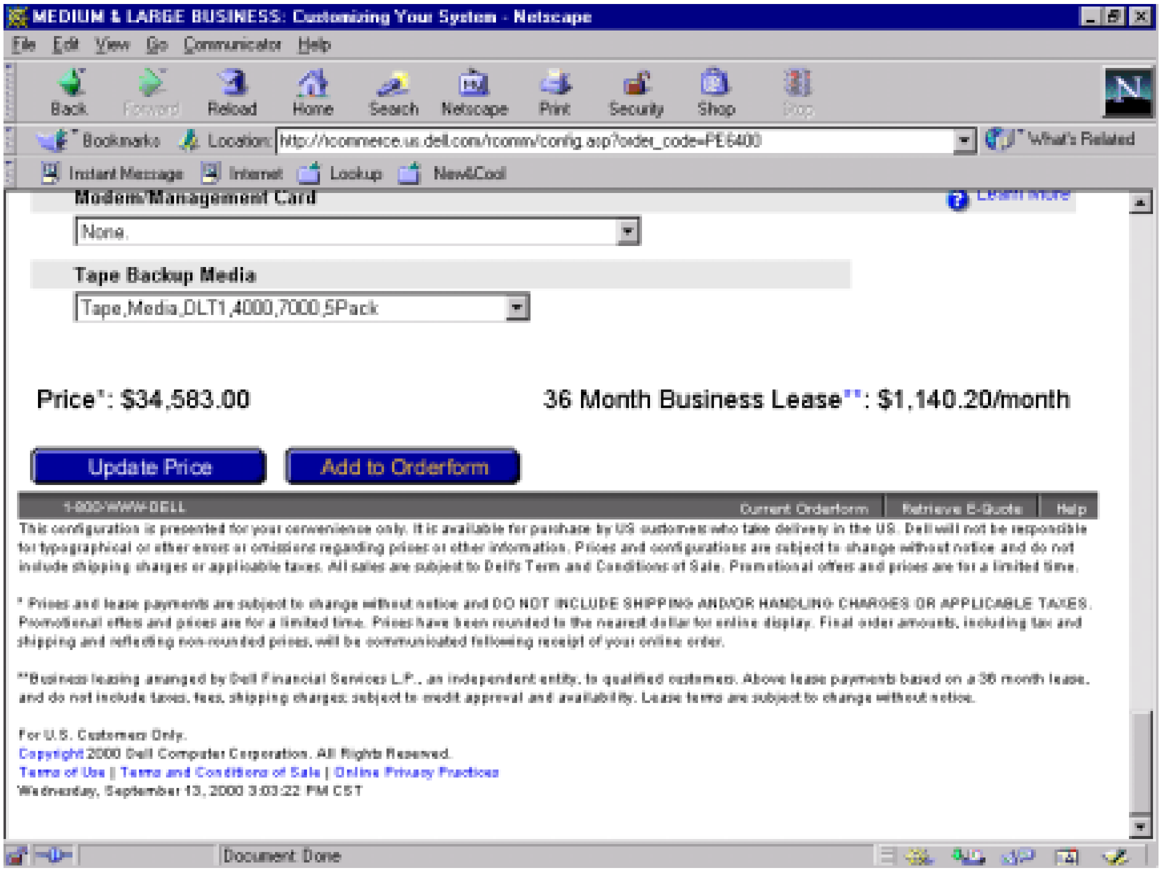
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Modem/Management Card
Learn More
None.
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Tape,Media,DLT1,4000,7000,5Pack
Price*: $34,583.00
36 Month Business Lease**: $1,140.20/month
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Wednesday, September 13, 2000 3:03:22 PM CST
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Appendix G Production Environment

Sun Server estimated cost without discount:

ITEM	COST
E450 Server	$13,600
400 MHz CPU (4@$6,000)	24,000
Video Adapter	270
External 509.6 GB Array Storage	61,333
Host Storage Adapter	1,770
512 MB Memory Expansion (2@$4,200)	8,400
Power Supply	1,333
Bay Storage Expansion Kit	1,333
560 GB AutoLoader Tape Drive	10,900
Tape Cassettes (10@$80)	800
17" Color Monitor	467
Tape Drive Adapter	1,500
Rack Mounting Kit	666
Ultra SCSI Card	533
Expansion Cabinet	7,500
Total	$134,405